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Bayesian Structural Equation Modeling of Quality of Life Mediated by Difficulty in Daily Life in Perioperative Breast Cancer Patients

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Abstract

Objectives: This study was aimed to clarify the structural relationship of quality of life (QOL) in perioperative breast cancer patients.

Materials and Methods: Participants in this prospective case-series study were inpatients who underwent surgery for initial breast cancer between October 2020 and September 2021. Five assessments were used at discharge; Functional Assessment of Cancer Therapy (FACT-B) for QOL, Hospital Anxiety and Depression Scale (HADS) for anxiety and depression, sense of coherence (SOC)-13, World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) for difficulty in daily life, and Classification and Assessment of Occupational Dysfunction (CAOD) for negative experiences in daily activities. A hypothetical model was constructed using difficulty in daily life and negative experiences in daily activities as latent variables. Bayesian structural equation modeling was performed to analyze the hypothesized model. If the causal model was significant, multiplication of the path coefficient from emotional distress to QOL, and from SOC to emotional distress, was considered a direct effect on QOL, and from SOC to difficulty in daily life, from difficulty in daily life to negative experiences in daily activities, and from negative experiences in daily activities to anxiety and depression were considered indirect effects on QOL.

Results: Bayesian estimation showed stable convergence statistics and indicated a reliable estimation result. The direct effect was 0.211, and the indirect effect was 0.269.

Conclusions: Support for QOL in postoperative breast cancer patients may increase QOL by addressing not only direct factors such as anxiety and depression but also by alleviating difficulty in daily life and addressing the resulting negative subjective aspects.

Keywords: Breast cancer, Structural equation modeling, Quality of life

Introduction

Breast cancer patients in the perioperative period are likely to experience psychological problems such as anxiety and depression as they face ongoing treatment and daily life after discharge from hospital, and their quality of life (QOL) is likely to be decreased. After surgery, many breast cancer patients experience severe anxiety about recurrence or metastasis because they wish to resume their daily lives (1). Further, within 1 year after surgery, many breast cancer patients present with depression and have the highest need for supportive care (2). In a survey by Nguyen et al (3), 63.6% of cancer patients after initial discharge reported the need for supportive care for QOL. Prior research suggests specific support methods to enhance the QOL of breast cancer patients, including physical activities such as aerobic exercise, walking, and yoga (4), stress reduction strategies (5), and interventions to improve depression (6). However, breast cancer patients with a short hospital stay find themselves navigating social life while medical treatment continues, leading to increased negative emotions such as anxiety and depression, which continue after surgery (7-9). Therefore, despite the need for strategies to address the decline in QOL and psychological issues such as anxiety and depression in the context of daily life faced by breast cancer patients, integrated models are lacking.

When considering a patient's QOL, it is necessary to consider difficulty in daily life and subjective factors (10). Lourenço et al (11) pointed out that patients with a low QOL experience many difficulties in their daily lives. The long-term effects of cancer and cancer treatments are key factors in developing disability in several aspects of life, such as mobility, participation in society, and self-care (12). Focusing on a patient's difficulties is an important perspective to enhance QOL as difficulties affect patient performance at the individual, family, and societal levels. Furthermore, a notable factor that impacts difficulties in daily life, termed "occupational dysfunction," is defined

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Key Messages

- The direct and indirect effects on QOL based on difficulty in daily life of perioperative breast cancer patients were identified.
- The direct effects of SOC and anxiety/depression on QOL was similar as shown in previous studies.
- The indirect effects of mediating "difficulty in daily life" and "negative experiences in daily activities" were new findings.
- This model may indicate increase in QOL by intervening in difficulty in daily life and negative subjective aspects.

as negative experiences encountered by individuals when engaging in routine activities. This represents an important health-related issue that has emerged primarily in the field of preventive occupational therapy (13). We validated a factor structure model in QOL for breast cancer survivors and showed that in addition to the sense of coherence (SOC), anxiety and depression, which are directly related factors shown in previous studies, difficulty in daily life, and negative experiences in daily activities are mediating variables for increasing QOL (14). This model shows the potential to increase QOL by not only decreasing difficulty in daily life but also by intervening in negative experiences in daily activities as a subjective aspect arising from difficulties in daily life (14). However, whether such support is also effective in perioperative breast cancer patients has not been examined, and the effect of interventions affecting QOL after discharge, which is the period of medical treatment in the outpatient setting, is not clear.

Considering that variables related to QOL in perioperative breast cancer patients include difficulty in daily life and negative experiences in daily activities, a hypothetical model was developed to construct a structural equation model of QOL based on difficulty in daily life (Figure 1). This hypothetical model is similar to the structural equation modeling for breast cancer survivors previously reported (14). SOC (15), which is referred to as a stress-coping capacity, is a predictor of QOL (16), and it has been reported that higher levels of SOC are associated with less anxiety and depression and higher QOL (17), and scattered reports show that QOL tends to be lower when anxiety and depression are high (7-9). This hypothetical model is based on the direct relationship from "SOC" to "emotional distress" and from "emotional distress" to "QOL" as shown in previous studies, as well as additional structural relationships from "SOC" to "emotional distress" and "QOL" mediated by "difficulty in daily life" and "negative experiences in daily activities" as mediators. If the hypothesized model is validated, it may be useful in supporting perioperative patients to increase their QOL after discharge from hospital by alleviating difficulties in their postoperative lives and negative experiences in daily activities. Therefore, the purpose of this study was to clarify the structural relationship of QOL in perioperative breast cancer patients, including difficulty in daily life and negative experiences in daily activities.

Materials and Methods

Participants

Participants in this prospective case-series study were consecutive inpatients who underwent surgery for initial breast cancer at two hospitals between October 2020 and September 2021. The eligibility criteria included individuals who were admitted for initial breast cancer surgery, were 20 years of age or older, and understood the questionnaire and provided individual consent for participation in this study. Individuals with dementia, psychiatric disorders, and physical disabilities before breast cancer surgery, and surgery has been cancelled were excluded from participation. The flowchart of data selection was shown in Figure 2.

Procedure

General information such as gender, age, family structure, and employment, and medical information such as diagnosis, date of surgery, type of surgery, and stage classification, were collected from the medical records and participants. The assessment included the following measures: Functional Assessment of Cancer Therapy-Breast (FACT-B) for evaluating QOL, Hospital Anxiety and Depression Scale (HADS) for assessing emotional distress, the 13-item Sense of Coherence (SOC-13) scale for evaluating SOC, World Health Organization Disability

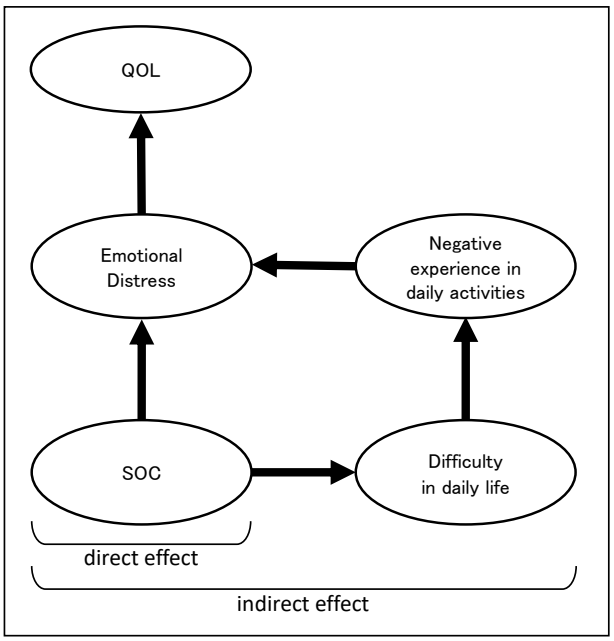

Figure 1. The Hypothesis Model. A hypothetical model of QOL in survivors of breast cancer includes the direct effect of "SOC" to "Anxiety and Depression" to "QOL", and the indirect effect of "Difficulty in daily life" to "Negative experiences in daily activities" as mediating variables. QOL = quality of life; SOC = Sense of Coherence.

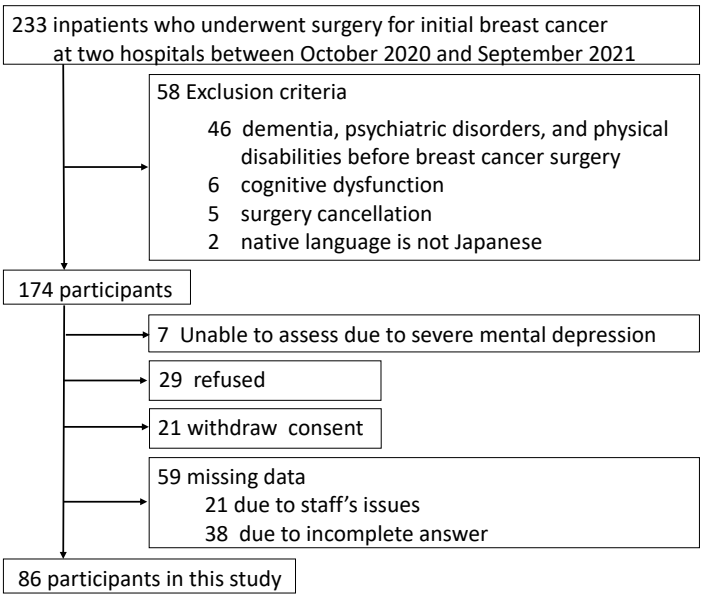

Figure 2. Flowchart of Data Selection. Eighty-six inpatients who underwent surgery for initial breast cancer were included in the analysis.

Assessment Schedule 2.0 (WHODAS 2.0) for measuring difficulty in daily life, and Classification and Assessment of Occupational Dysfunction (CAOD) for examining negative experiences in daily activities. All of these assessments were self-administered and conducted at the time of discharge.

FACT-B

The FACT-B (18), a cancer-specific QOL scale, involves answering questions about one's condition over the past 7 days. FACT-B is comprised of five domains: Physical Well-Being, Social/Family Well-Being, Emotional Well-Being, Functional Well-Being, and the Breast Cancer Subscale. Participants respond to 37 questions using a 5-point Likert scale ranging from 0 (does not apply at all) to 4 (applies very well). The total score ranges from 0 to 148 and is calculated using a specified scoring method, with higher total scores indicating a higher QOL. The "Version 4 Japanese version" was used in this study.

HADS

The HADS is an anxiety and depression scale (19) that is answered by considering the patient's state over the past week. It consists of seven items each that assess anxiety (HADS-A) and depression (HADS-D). Participants answer 14 questions on a 4-point Likert scale from 0 to 3. HADS-A and HADS-D score from 0 to 21, respectively, with 0–7 points indicating no anxiety or depression, 8–10 points indicating suspicion of anxiety or depression, and 11 or more points indicating definite anxiety or depression (19). Higher scores indicate higher levels of anxiety and depression.

SOC-13

SOC is the ability to cope with stress and consists of three senses: "comprehensibility," "manageability," and "meaningfulness" (15). "Comprehensibility" is the sense of understanding one's present situation and being able to predict future situations to some extent; "manageability" is the sense of being able to manage and get by in life; and "meaningfulness" is the sense of coping with stress and finding meaning in one's daily activities. SOC has been identified as a predictor for QOL (16,20), and higher levels of SOC are reported to be associated with lower levels of anxiety and depression and higher QOL (17,21). In this study, the SOC-13 (22), a 7-point Likert scale consisting of 13 items, was used. The SOC-13 is scored from 1 to 7 points for each item. Scoring for the SOC-13 ranges from 13 to 91 points, with a general average falling between 54 and 58 points. Higher scores indicate better stress-coping abilities.

WHODAS 2.0

WHODAS 2.0 is a disability assessment tool that considers the difficulties patients face in performing a series of activities due to their health condition and provides a global disability score (10,23,24). WHODAS 2.0 is a useful scale for assessing difficulties in the daily lives of breast cancer patients (12,25,26). The 36-item self-administered version of the WHODAS 2.0 (23) was used in this study. In this version, the individual's functional level is assessed across six primary domains of life: cognition, mobility, self-care, getting along, life activities, and participation in society. Participants respond to 36 questions, with six questions for each domain, using a 5-point Likert scale ranging from "No problem" to "I can't do anything at all." All scores, including the total score and scores for each major life domain, range from 0 to 100 points. Higher scores indicate greater difficulties in health-related activities in daily life.

CAOD

CAOD assesses occupational dysfunction as a negative experience that individuals encounter when they cannot perform daily activities appropriately (27). This concept encompasses four domains in which individuals perceive limitations in their ability to perform activities of daily living. These four domains are defined as follows: occupational imbalance, a loss of balance when performing daily activities; occupational alienation, situations for which an individual's inner needs related to daily activities are not met; occupational deprivation, loss of opportunities to perform daily activities that are beyond the individual's control; and occupational marginalization, loss of an individual's opportunities to perform desired daily activities (27,28). Participants were asked to respond to 16 questions on a 7-point scale ranging from "1 (disagree)" to "7 (agree)." The score range is from 16 to 112 points, with higher total scores indicating more severe negative experiences.

Analysis

Spearman's rank correlation coefficient was used to analyze the relationship between each variable. A P value of <0.05 was considered statistically significant. A confirmatory factor analysis was used to confirm the structural validity of the five assessment scales, and reliability coefficients were analyzed. The GFI (goodness-of-fit index) was obtained by mapping the sub-items affected by each factor and creating a model that assumed covariance among all factors. The sub-items of each scale were considered based on the goodness-of-fit index (GFI), adjusted GFI (AGFI), and RMSEA (root mean square error of approximation), with Cronbach's alpha coefficient calculated to confirm the internal consistency of each scale. The acceptable ranges were set at GFI >0.85, AGFI >0.85 (29), and RMSEA <0.08 (30). Furthermore, based on Bayesian structure equation modeling (BSEM) of QOL in breast cancer survivors previously reported (14), a hypothetical model (Figure 1) was constructed and validated using difficulty in daily life and negative experiences in daily activities as latent variables. The BSEM method was utilized due to the small sample size of this study (31). Bayesian analysis is useful in that it allows for adjustment of the prior distribution based on subjective and available information (31). The prior distributions were established following previous research, with normal distributions assigned to FACT-B and HADS and to SOC and HADS. Due to insufficient information from prior studies, other coefficients were analyzed using non-informative distributions. Sensitivity analyses with different prior distribution settings were also conducted. The prior distribution for the sensitivity analysis was a uniform distribution with no specified range. If the causal model is significant, the product of the path coefficients from "Emotional distress" to "QOL" and "SOC" to "Emotional distress" were considered as direct effects on QOL, and from "SOC" to "Difficulty in daily life," "Difficulty in daily life" to "Negative experiences in daily activities," and "Negative experiences in daily activities" to "Emotional distress" were considered as indirect effects on QOL. BSEM estimation was conducted using a Markov chain Monte Carlo method. The goodness of fit of the model was evaluated using the posterior predictive method and the posterior predictive P value (PPP), with PPP >0.10 indicating a good fit of the model (32). Path coefficients and corresponding 95% confidence intervals (CIs) between the latent variables in the model were analyzed. A path coefficient was considered statistically significant if the 95% CIs did not include zero. The model was run for a total of 100 000 sampling times, and convergence of the algorithm was indicated by a convergence statistic set at <1.002.

Statistical analyses were conducted using SPSS Statistics 27 software (IBM, USA) and SPSS Amos ver. 25.0 (IBM, USA).

Results

Participant Characteristics

The characteristics of the participants are shown in Table 1. The participants comprised 86 breast cancer

Table 1. Characteristics of the Participants

Characteristic	Value
Participants [n]	86
Male	0
Female	86
Age [years (range)]	58.1±12.6 (36–82)
Period of hospitalization [days (range)]	6.7±3.2 (2–17)
Marital status [n]	
Married	64 (74.4%)
Divorced	5 (5.8%)
Not married	12 (14.0%)
Bereaved	5 (5.8%)
Family structure [n]	
Living together	73 (84.9%)
Separate	13 (15.1%)
Type of surgery [n]	
Mastectomy	46 (53.5%)
Breast-conserving surgery	38 (44.2%)
Lumpectomy	2 (2.3%)
Clinical stage [n]	
0	8 (9.3%)
I	42(48.9%)
II	26 (30.2%)
III	10 (11.6%)
IV	0 (0.0%)
Treatment after surgery [n]	
Chemotherapy	24 (27.9%)
Radiotherapy	35 (40.7%)
Hormone therapy	28 (32.6%)
Others	22 (25.6%)
Current job status [n]	
Working	44 (51.2%)
Not working	42 (48.8%)

Values are mean ± standard deviation (range), number (percent).

inpatients with an average age of 58.1 ± 12.6 years. More than half of the participants underwent mastectomy, and about half of them were in clinical stage I. The average stay in the hospital was about one week, and about half of the participants were employed.

The scores for each assessment scale are shown in Table 2. Both the FACT-B total and each domain were higher than the median of the score range. The average scores on the HADS-A and -D were lower than the cutoff values, and most participants were judged not to be anxious or depressed. The average scores on the SOC-13 were higher than the general average of 54–58, indicating that most participants had high stress-coping skills. The WHODAS 2.0 scores showed a trend for feeling difficulty in society, in getting along, and in life activities. The total score of CAOD and that for all domains was lower than the median of the respective score ranges.

Relationship Between Each Assessment Scale

Spearman's rank correlation analysis was used to determine the correlation between each rating scale, and significant correlations were found among the scales. There was also a significant negative correlation between age and the CAOD score. There was no significant correlation with the period of hospitalization (Supplementary file 1, Table S1). A confirmatory factor analysis was performed on the sub-items of each rating scale. The goodness-of-fit indices of GFI, AGFI, and RMSEA were as follows: FACT-B: GFI = 0.982, AGFI = 0.908, RMSEA = 0.066; HADS: GFI = 0.917, AGFI = 0.873, RMSEA = 0.000; SOC-13: GFI = 0.928, AGFI=0.883, RMSEA = 0.000; WHODAS 2.0: GFI = 0.769, AGFI = 0.700, RMSEA = 0.069; and CAOD: GFI = 0.881, AGFI = 0.816, RMSEA = 0.039. These values confirm that the original factor structure of each assessment scale is supported by the data. Cronbach's alpha was 0.674 for FACT-B, 0.791 for HADS, 0.762 for SOC-13, 0.876 for WHODAS 2.0, and 0.728 for CAOD.

Table 2. Assessment Scores

Assessment (Range of Score)	Score at Discharge (Range)
FACT-B	
Total score (0-148)	99.3 ± 17.0 (49–140)
Physical Well-Being (0-28)	20.3 ± 5.2 (3–28)
Social/Family Well-Being (0-28)	19.1 ± 5.8 (0–28)
Emotional Well-Being (0-24)	17.3 ± 4.0 (8–24)
Functional Well-Being (0-28)	17.6 ± 5.7 (0–28)
Breast Cancer Subscale (0-40)	24.9 ± 5.4 (10–37)
HADS	
Total score (0-42)	11.4 ± 6.3 (1–26)
HADS-A: Anxiety (0-21)	5.4 ± 3.6 (0–14)
HADS-D: Depression (0-21)	6.1± 3.4 (0–13)
SOC-13	
Total score (13-91)	62.4 ± 11.4 (30–91)
Comprehensibility (5-35)	23.9 ± 5.5 (11–35)
Manageability (4-28)	18.7 ± 4.3 (7–28)
Meaningfulness (4-28)	19.8 ± 4.1 (5–28)
WHODAS 2.0 (0-100)	
Total score	17.3 ± 15.3 (0–78)
Cognition	7.0 ± 10.7 (0–50)
Mobility	14.5 ± 20.9 (0–94)
Self-care	9.9 ± 13.8 (0–50)
Getting along	21.5 ± 24.2 (0–92)
Life activities	21.2 ± 21.9 (0–88)
Participation in society	26.5 ± 21.9 (0–100)
CAOD	
Total score (16-112)	38.7 ± 16.1 (16–85)
Occupational imbalance (4-28)	9.0 ± 6.0 (4–27)
Occupational deprivation (3-21)	8.9 ± 4.9 (3–20)
Occupational alienation (3-21)	9.1 ± 4.7 (3–21)
Occupational marginalization (6-42)	11.6 ± 6.1 (6–31)

Scores are mean ± SD (range).

FACT-B, Functional Assessment of Cancer Therapy-Breast; HADS, Hospital Anxiety and Depression Scale; SOC, Sense of Coherence; WHODAS 2.0, WHO Disability Assessment Schedule 2.0; CAOD, Classification Assessment of Occupational Dysfunction.

Structural Relationship of QOL, Emotional Distress, SOC, Difficulty in Daily Life, and Negative Experiences in Daily Activities

BSEM was used to analyze the hypothesized causal model of QOL (Figure 1). The latent variables of the model were "QOL," "Emotional distress," "SOC," "Difficulty in daily life," and "Negative experiences in daily activities," and the observed variables were the scores on the sub-items of each evaluation scale. Bayesian estimation showed stable convergence statistics, with values ranging from 1.000 to less than 1.002, which indicates a reliable estimation result. The standardized path coefficients [95% CI] in the BSEM analysis between each latent variable were as follows: the direct effect from "SOC" to "Emotional distress" was -0.257 [-0.262, -0.256] and from "Emotional distress" to "QOL" was -0.821 [-0.822, -0.818], both of which were statistically significant. Therefore, the direct effect from "SOC" to "QOL" via "Emotional distress" was 0.211 (-0.257 × -0.821). In addition, the score from "SOC" to "Difficulty in daily life" was -2.555 [-2.568, -2.524], from "Difficulty in daily life" to "Negative experiences in daily activities" was 0.094 [0.092, 0.095], and from "Negative experiences in daily activities" to "Emotional distress" was 1.366 [1.357, 1.378], all of which were statistically significant. The indirect effect from "SOC" to "QOL" via "Difficulty in daily life" and "Negative experiences in daily activities" was 0.269 (-2.555 × 0.094 × 1.366 × -0.821) (Figure 3). Furthermore, in the sensitivity analysis conducted using BSEM, the PPP was found to be 0.20, indicating that the model fit was adequate. The model fit in the sensitivity analysis was also acceptable, with a direct effect of 0.211 and an indirect effect of 0.269 (Figure S1).

Discussion

Regarding the structural relationship of QOL in perioperative breast cancer patients, the direct effect supporting the previous finding that an increase in SOC, the ability to cope with stress, leads to an increase in QOL via anxiety and depression, as well as the indirect effect

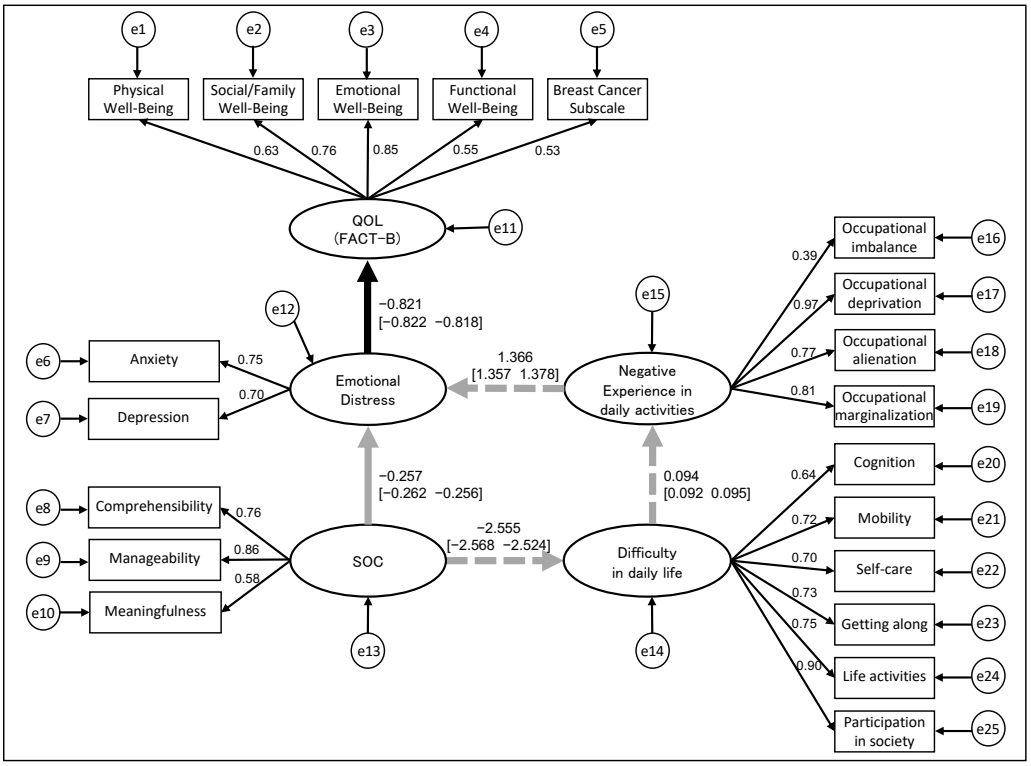

Figure 3. Structural Relationship Between Quality of Life Mediated by Difficulty in Daily Life and Negative Experiences in Daily Activities Using Bayesian Structural Equation Modeling. The values in this figure indicate the standardized path coefficients (95% confidence interval). The prior distributions were established with normal distributions assigned to FACT-B and HADS and to SOC and HADS, respectively. Other coefficients were analyzed using non-informative distributions. PPP=0.20; Model fit is good. Direct effect (solid gray and black lines)=0.211, "SOC" – "Emotional distress" – "QOL". Indirect effect (dashed gray lines)=0.269, "SOC" – "Difficulty in daily life" – "Negative experiences in daily activities" – "Emotional distress" – "QOL". QOL=quality of life; SOC=Sense of Coherence; PPP=posterior predictive *P* value.

that a decrease in difficulty in daily life and negative experiences in daily life leads to an increase in QOL via anxiety and depression, establishes a structure similar to that of previously reported breast cancer survivors (14). All path coefficients were significant for the relationship between each latent variable. Higher stress-coping skills are associated with less anxiety and depression, and less anxiety and depression are associated with higher QOL. These were shown as direct effects and, as in breast cancer survivors, supported the previous findings (16,17,33). As well, higher stress-coping skills are associated with lower difficulty in daily life, lower difficulty in daily life is associated with fewer negative experiences, and fewer negative experiences are associated with lower anxiety and depression. These were shown as indirect effects, with similar associations as in breast cancer survivors. The coefficients for direct and indirect effects for previously reported survivors were 0.274 and 0.164, respectively, with the direct effect being larger (14). However, the coefficient for direct effect was 0.211 and that for indirect effect was 0.269 in the perioperative patients, indicating that the indirect effect was larger than the direct effect. Breast cancer has a relatively long postoperative course and a high survival rate among cancers. The indirect effect was smaller than the direct effect because although those who could participate in the previous study as survivors also had anxiety and difficulties in their lives, they had adapted to society (34) and were able to control their difficulty in daily life and negative experiences. In contrast, the indirect effects are larger in perioperative patients, and interventions aimed at alleviating the participants' subjective feelings of difficulty in daily life and negative experiences in social life that they will face after discharge from the hospital will be important in the immediate postoperative period.

SOC, positioned as a variable related to both direct and indirect effects, is an inverse measure of psychological distress and negative affect (35). SOC stabilizes by about age 30, and after that, it is unlikely to fluctuate significantly, although it may change due to major life experiences (36). As interventions for direct effects, pharmacotherapy, exercise therapy (37), and psychotherapy (38) such as cognitive behavioral therapy (39,40) and UP (Unified Protocol for Transdiagnostic Treatment of Emotional Disorders) (40,41) have been effective in addressing anxiety and depression. In addition to these interventions to increase QOL, when focusing on indirect effects, interventions involving difficulty in daily life and negative experiences in daily activities may also be effective.

The patients in this study were assessed at the time of

discharge from hospital after the initial surgery and were found to have a relatively preserved QOL and no anxiety or depression. However, anxiety and depression can continue after completion of initial treatment, with 25% of patients stating that they have symptoms of anxiety and depression 1–4 years after diagnosis (42). Moreover, the QOL of breast cancer survivors is likely to decrease due to treatment side effects, unemployment, and other factors (43). Even if a patient's QOL is relatively better at the time of discharge and no anxiety and/or depressive symptoms are present, the patient's QOL may worsen in the future. Therefore, it is necessary to carefully monitor QOL, anxiety, depression, and other issues in the post-discharge period. Furthermore, regarding the significant negative correlation between age and CAOD, it is interesting to note that the younger participants perceived the negative experiences in their lives to be severe. Breast cancer patients tend to be younger at diagnosis compared to patients with other cancers, and many of them have important roles in social life, such as in childcare and employment. Approximately half of the participants in this study were employed and fell within the productive age group. They tended to have negative feelings about their lives due to concerns that being diagnosed and treated for breast cancer is a negative experience and that they will not be able to fulfill their roles in their lives. The results of WHODAS2.0 suggest that the negative experiences are mainly felt in getting along, life activities, participation in society, and that alleviating these difficulties may increase QOL after discharge.

Although a careful literature review was conducted in constructing the hypothetical model, because this is a prospective case-series study, a longitudinal data-based analysis of time-dependent causal relationships is necessary. There were selection biases that need to be carefully considered to determine whether the insights gained from this model can be generally applied. To address the bias, participants were recruited consecutively over a period of time and according to eligibility and exclusion criteria. Furthermore, we focused on the difficulty in daily life, which was a mediating factor, and the subjectivity of the negative experiences that contributed to this difficulty, and used the CAOD as an assessment of the negative experiences in daily activities resulting from difficulty in daily life. Factors influencing negative emotions in cancer patients include economic issues (44), trait anxiety (45), stressful life events (46), and tendencies to inhibit emotions (7), among others. The possibility of decreased QOL due to these factors, which were not investigated in this study, cannot be overlooked. However, the model proposed in this study suggests new and potentially beneficial information that patients and healthcare staff can implement in postoperative life, which may increase the QOL of breast cancer patients.

Conclusions

In this study, a comprehensive model of QOL in perioperative breast cancer patients was constructed using difficulty in daily life and negative experiences in daily activities as mediating factors. Support for QOL in postoperative breast cancer patients may increase their QOL by addressing not only direct factors such as anxiety and depression but also by alleviating difficulty in daily life and addressing the resulting negative subjective aspects. These direct and indirect approaches to difficulty in daily life contribute to support strategies that increase the QOL of breast cancer patients. Looking ahead, it is imperative to explore seamless supportive care that bridges the postoperative phase of these patients as they transition to survivorship by assessing how daily life challenges and experiences influence changes in QOL over time. This could provide valuable insights into optimizing support interventions for breast cancer patients at different stages of their journey.

Authors' Contribution

Conceptualization: Aki Watanabe, Takayuki Kawaguchi, Takeshi Kobayashi.
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Validation: Aki Watanabe, Takayuki Kawaguchi.
Visualization: Aki Watanabe, Takayuki Kawaguchi.
Writing–original draft: Aki Watanabe, Takayuki Kawaguchi.
Writing–review & editing: Aki Watanabe, Takayuki Kawaguchi, Misuzu Kaneko, Kuninori Sano, Ayumi Nobematsu, Takeshi Kobayashi.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

This study was performed in accordance with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Kitasato University School of Allied Health Sciences (approval No. 2019-030-2) and each participating hospital. The purpose and content of the study were explained, and informed consent was obtained from all individual participants included in the study.

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Supplementary files

Supplementary file 1 contains Figure S1 and Table S1.

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